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(PATENT)

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:  
Dr. Igor A. Krichtafovitch, et al.

Application No.: 09/419,720

Group Art Unit: 2821

Filed: October 14, 1999

Examiner: E. Alemu

For: ELECTROSTATIC FLUID ACCELERATOR

SUPPLEMENTAL COMMUNICATION

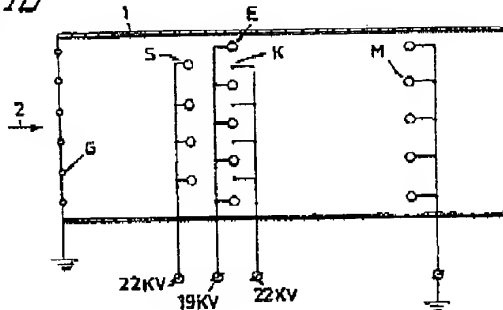
Commissioner for Patents  
Washington, DC 20231

Dear Sir:

The following comments are directed to Figure 10 of Török et al., U.S. Patent No. 4,812,711 ("Török '711") and to the other patents submitted by the Information Disclosure Statement filed September 20, 2002.

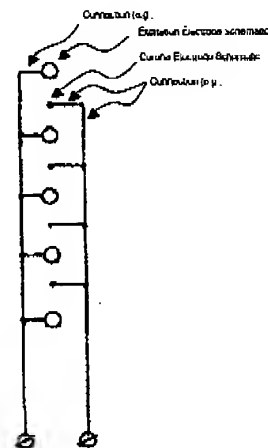
Török et al., U.S. Patent No. 4,812,711 ("Török '711") describes a corona discharge apparatus for transporting air. Figure 10 of the drawings is one of several that "illustrate schematically a number of different embodiments of an arrangement according to the invention...". Török '711 specification at column 2, lines 64 - 66. Figure 10 as it appears in the patent is shown below together with a labeled enlargement of that portion of the drawing depicting Corona Electrodes K and Excitation Electrodes E.

*Fig. 10*



25211331.2

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It should be emphasized that Figure 10 is a schematic diagram, with the various elements shown by appropriate symbology, Corona Electrodes K clearly represented by small dots, while Excitation Electrodes E, Target Electrodes M, and Screen Electrodes S are represented by small circles. Each group of electrodes are electrically connected together by some electrical path (e.g., wire) depicted as lines, as is conventional in schematic diagrams. As in other schematic diagrams, Figure 10 employs or constitutes a scheme of conventional symbols to depict the relationship between and among the various elements. A symbol may be defined as:

**"Something that stands for or suggests something else by reason of relationship, association, convention, or accidental but not intentional resemblance"**

Webster's Third New International Dictionary (emphasis added).

Thus, recognizing that Corona Electrodes K are represented by black dots positioned at terminal ends of electrical connections, it is clear that, if anything, the Corona Electrodes are exactly aligned with Excitation Electrodes E in a symmetrical fashion. This interpretation is further supported by Török '711 specification at column 21, lines 30 - 64 and, in particular, lines 49 - 42:

...the electrode element of the excitation electrode E was arranged in the same plane as the electrode elements of the corona electrode K centrally therebetween.

Thus, it is clear that no asymmetrical relationship between the electrodes is taught or suggested by Figure 10 of Török '711.

In summary, neither Figure 10 of Török '711 nor the associated written description of the Figure depict, describe, or suggest the subject matter of applicant's claims including, *inter alia*, "at least one exciting electrode shaped as a plate extending downstream with respect to a desired fluid flow direction, said at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction...."

The following table summarizes the indicated patents as previously submitted and directs the Examiner's attention to one or more features distinguishing the invention over each disclosure. Note that, however, the distinguishing features listed are based on Applicants' interpretation of the disclosure and are not intended to be all

inclusive; other distinguishing features and characteristics may exist together with additional reasons why the present invention is allowable thereover. Applicants reserve the right to provide additional reasons and support for patentability in addition to the summary information contained herein.

Patent No	Brief Description of Patent	Distinguishing Feature(s) of Claims
1,888,606	Method and apparatus for cleaning gases. Contains several rows of the discharge electrodes producing electric wind.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
2,949,550	Thrust producing apparatus comprising an electroconductive body having ... smooth area and an electrode supported on said body	Does not disclose or suggest multiple corona electrodes.
3,108,394	A plurality of electrodes connected to a first and second groups a source of direct current and alternating current both connected to said groups	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
3,267,860	Series of cone-like pumps	Does not disclose or suggest multiple corona electrodes.
3,374,941	AIR BLOWER	Does not disclose or suggest multiple corona electrodes.
3,518,462	FLUID FLOW CONTROL SYSTEM	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
3,582,694	Previously made of record by Examiner. See Office Action dated 12/21/2000	
3,638,058	Ion wind generator	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
3,675,096	Corona generating device with a silver screen to convert ozone to oxygen	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
3,699,387	Ionic wind machine with the arcing electrode as a moving belt cleaned outside of the corona area. (See also 3,751,715.)	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
3,751,715	Similar to 3,699,387. Also provides a water filled hollow bars as a liquid corona wires. Continuous corona and collecting electrodes are cleaned outside of the active area.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
3,896,347	Corona wind generating device A device, which generates a corona wind that circulates about the support rods for the emitter wires in an electrostatic precipitator to discourage accumulation of oil and dust particles on the insulators from which the support rods are suspended, includes a ground shell	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is

Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
	which spacedly surrounds the support rods and a plurality of pointed coronaemitting members that are mounted to the support rod within the shell and that are spatially arranged to cause the circulating gaseous flow within the shell which carries entrained particulates to collection on the interior walls of the shell	generated in said desired fluid flow direction . "
3,936,635	Wire screen is located between corona wire and a plate for more uniform discharge.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
3,983,393	Corona wire is surrounded by ozone reducing members close to corona glow region.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
4,008,057	Electrically-activated shaking devices are arranged in modules to shake the electrodes of an electrostatic precipitator, each module corresponding to a different section of the precipitator. An operating system for the shaking devices includes a main distributor circuit that sends electrical signals to individual control circuits at each of the modules in sequence and at a relatively fast rate. Each control circuit has an adjustable timer that independently generates pulses at a relatively slow rate and a synchronizing circuit that generates an output signal only if it receives a signal from the timer followed by a signal from the main distributor. Each control circuit further includes a secondary distributor circuit that operates in response to the synchronizing circuit to activate the shaking devices in the associated module sequentially. An inhibit device operated by the synchronizing circuit prevents more than a single shaker from being activated at a time.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
4,011,719	Anode for ion thruster. Accelerating electrode is made of stainless steel mesh or covered with tantalum	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
4,061,961	A circuit for controlling the duty cycle of a two-stage electrostatic precipitator power supply. The circuit includes a switching device connected in series with the primary winding of the power supply transformer and a circuit operable for controlling the switching device. A capacitive network, adapted to monitor the current in the primary winding of the power supply transformer, is provided for operating the control circuit. Under normal operating conditions, i.e., when the current in the primary winding of the power supply transformer is within normal limits, the capacitive network operates the control circuit to allow current flow through the power supply transformer primary winding in a normal manner. However, upon sensing the increased primary current level associated with a high voltage transient generated by arcing between components of the precipitator and reflected from the secondary winding of the power supply transformer to the primary winding thereof, the capacitive network operates the control circuit for causing the switching device to inhibit current flow through the primary winding substantially until the arcing condition associated with the high voltage transient is suppressed. Following an interval after termination of the high voltage transient, the switching device is automatically caused to re-establish primary winding current flow thereby re-establishing normal operation of the electrostatic precipitator power supply.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
4,086,650	Corona wire is coated with non-conductive material. AC + DC voltage applied to energize and accelerate corona discharge and ions.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
4,124,003	Ignition method for internal combustion engine. Ion wind is used to produce air-fuel mixture	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "

Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
4,156,885	Automatic current overload protection circuit for electrostatic precipitator power supplies after sustained overload happened	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,162,144	Method and apparatus for treating electrically charged airborne particles. A method and apparatus for treating electrically charged airborne particles to reduce deposition of the particles on walls and other exposed surfaces in an enclosed area. Air containing positively charged particles exhausted from a first group of electrostatic precipitators is admixed with air containing negatively charged particles exhausted from a second group of electrostatic precipitators, the mixed air containing oppositely charged particles having less tendency to become deposited on walls and other surfaces in the enclosed area.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,210,847	Electric wind generator	Does not disclose or suggest multiple electrodes
4,231,766	Two stage electrostatic precipitator with electric field induced airflow A two stage electrostatic precipitator air cleaner having electric field induced airflow. A plurality of spaced parallel fin-like accelerator plates charged to a relatively high negative potential are positioned between the positively charged ionizer wires and the collecting stage of the air cleaner. The electric field induced between the accelerator plates and the ionizer wires induces an airflow for bringing the particles charged by the ionizer wires into proximity with the collecting stage while at the same time charging particles aspirated by the airflow.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,240,809	Electrostatic precipitator having traversing collector washing mechanism. An electrostatic precipitator air cleaner including a number of precipitator cells having spaced parallel plates for collecting dirt particles, and a vertically disposed traversing pipe-like spray header containing a number of spray nozzles for directing a spray of wash or rinse fluid onto the collecting plates in order to remove collected particles. The header is traversed horizontally across the precipitator cells by means of a trolley supported by a rail-like guide member and reciprocated between a home position and an extended position by means of a rotating elongated helical drive screw cooperating with a gear-like follower attached to the trolley, such that the rotation of the screw produces linear motion of the header. The header is connected to a source of wash or rinse fluid by means of swivel connections and a flexible conduit. An elongated flat resilient fluid impervious strip containing a longitudinal slit in sliding sealable engagement with the header is positioned between the traversing mechanism and the spray nozzles to prevent infiltration of the precipitator airstream or wash fluid into the area occupied by the traversing mechanism. The threaded follower may also be disengaged from the helical drive screw and the header moved manually to any position along its length of travel.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,246,010	The disclosure relates to a base for supporting hollow cylindrical and circular in cross section collector electrodes for an electrostatic precipitator. The base comprises a central portion and is generally circular; a plurality of arcuate venturi and collector trough assemblies which are generally circular and which intersect radially disposed drain troughs, the venturi and collector trough assemblies being concentric with the center portion of the base and drain troughs extending radially outward from the center portion; a circular wall structure secured to outer ends of the drain troughs, fixture means for securing the collector electrodes on the drain troughs; uppermost portions of the drain troughs and the venturi and collector troughs being substantially flush with each other and the venturi and collector trough assemblies disposed on a common plane to provide for uniform laminar flow relative to the collector electrodes.	
RE30,480 1981	In an electrostatic precipitator, a downwardly directed corona discharge is produced at the entrance to dust collecting hoppers attached at the bottom of the precipitator chamber, the corona discharge being produced by an array of corona discharge points	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow

Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
4,150,885	Automatic current overload protection circuit for electrostatic precipitator power supplies after sustained overload happened	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,162,144	Method and apparatus for treating electrically charged airborne particles A method and apparatus for treating electrically charged airborne particles to reduce deposition of the particles on walls and other exposed surfaces in an enclosed area. Air containing positively charged particles exhausted from a first group of electrostatic precipitators is admixed with air containing negatively charged particles exhausted from a second group of electrostatic precipitators, the mixed air containing oppositely charged particles having less tendency to become deposited on walls and other surfaces in the enclosed area.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,210,847	Electric wind generator	Does not disclose or suggest multiple electrodes.
4,231,766	Two stage electrostatic precipitator with electric field induced airflow. A two stage electrostatic precipitator air cleaner having electric field induced airflow. A plurality of spaced parallel fin-like accelerator plates charged to a relatively high negative potential are positioned between the positively charged ionizer wires and the collecting stage of the air cleaner. The electric field induced between the accelerator plates and the ionizer wires induces an airflow for bringing the particles charged by the ionizer wires into proximity with the collecting stage while at the same time charging particles aspirated by the airflow.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,240,800	Electrostatic precipitator having traversing collector washing mechanism An electrostatic precipitator air cleaner including a number of precipitator cells having spaced parallel plates for collecting dirt particles, and a vertically disposed traversing pipe-like spray header containing a number of spray nozzles for directing a spray of wash or rinse fluid onto the collecting plates in order to remove collected particles. The header is traversed horizontally across the precipitator cells by means of a trolley supported by a rail-like guide member and reciprocated between a home position and an extended position by means of a rotating elongated helical drive screw cooperating with a gear-like follower attached to the trolley, such that the rotation of the screw produces linear motion of the header. The header is connected to a source of wash or rinse fluid by means of swivel connections and a flexible conduit. An elongated flat resilient fluid impervious strip containing a longitudinal slit in sliding sealable engagement with the header is positioned between the traversing mechanism and the spray nozzles to prevent infiltration of the precipitator airstream or wash fluid into the area occupied by the traversing mechanism. The threaded follower may also be disengaged from the helical drive screw and the header moved manually to any position along its length of travel.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,246,010	The disclosure relates to a base for supporting hollow cylindrical and circular in cross section collector electrodes for an electrostatic precipitator. The base comprises a central portion and is generally circular; a plurality of arcuate venturi and collector trough assemblies which are generally circular and which intersect radially disposed drain troughs; the venturi and collector trough assemblies being concentric with the center portion of the base and drain troughs extending radially outward from the center portion; a circular wall structure secured to outer ends of the drain troughs; fixture means for securing the collector electrodes on the drain troughs; uppermost portions of the drain troughs and the venturi and collector troughs being substantially flush with each other and the venturi and collector trough assemblies disposed on a common plane to provide for uniform laminar flow relative to the collector electrodes.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
RE30,480 1981	In an electrostatic precipitator, a downwardly directed corona discharge is produced at the entrance to dust collecting hoppers attached at the bottom of the precipitator chamber, the corona discharge being produced by an array of corona discharge points	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow

Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
	connected to a high voltage source and a grounded electrode grid positioned below the corona points near the hopper entrance either in the hopper or in the chamber	direction such that a desired fluid flow is generated in said desired fluid flow direction "
4,206,948	In a system for filtering fibers and particulates from a gas stream, a fiber separator (10) is disposed to remove fibers in gross quantity from the gas stream. A corona charging apparatus (20) is disposed downstream of the fiber separator (10) to impart electric charge to particulates and to fibers that escape removal from the gas stream by the fiber separator (10). An electrostatic filter medium (30), which may advantageously be mounted on the cylindrical wall of a drum filter, is disposed downstream of the corona charging apparatus (20) to remove electrically charged particulates and fibers from the gas stream. The corona charging apparatus (20) comprises at least one fiber-rejecting corona discharge electrode (21 or 25). The fiber-rejecting electrode (21) comprises a shielding portion (22) facing upstream and a corona discharge portion (23) facing downstream in the gas stream. The radius of curvature of the shielding portion (22) is greater than the radius of curvature of the corona discharge portion (23) in a plane parallel to the gas stream so that the corona discharge occurs in a region that is shielded from fibers carried by the gas stream.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
4,267,502	A precipitator voltage control system including an automatic voltage control (AVC) circuit, a firing circuit, an alarm circuit, a power-saving circuit, a remote set-point control circuit and a power supply, all of which are mounted on a single, readily interchangeable circuit board. The automatic voltage control circuit includes a highly responsive spark detection subcircuit which causes the transformer/rectifier voltage to be reduced to zero at the end of the half-cycle in which a spark occurs and then causes the voltage to remain at zero for a short period of time after which voltage is reapplied in a dual ramp manner causing it to rapidly reach a level below the precipitator arcing potential and then increase at a slower rate to the threshold of sparking. The firing circuit drives silicon-controlled rectifiers (SCRs) through optical couplers which provide several thousand volts of circuit isolation. The alarm circuit detects short-circuit and open-circuit conditions and causes automatic trip-out of the control circuit when such alarm conditions exist. The power-saving circuit allows operation of the precipitator to be monitored and the voltage thereof to be reduced during high resistivity conditions. The remote set-point control allows the drive current to be controlled from a remote source.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction . "
4,392,493	Ozone generated by welding is removed (converted to NO <sub>2</sub> ) by adding N or N <sub>2</sub> O to the welding spot.	Does not use corona discharge
4,313,741	An electric dust collector uses the corona discharge to charge and collect dust particles. Corona wire is located upstream from the negative and positive collecting electrodes.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
4,335,414	Automatic reset current cut-off for an electrostatic precipitator power supply An automatic electronic reset current cut-off protection circuit for electrostatic precipitator air cleaner power supplies of the type utilizing a ferroresonant transformer having a primary winding, a secondary winding for producing relatively high voltage and a tertiary winding for producing a relatively low voltage. The circuit operates to inhibit power supply operation in the event of an overload in the ionizer or collector cell by sensing a voltage derived from the high voltage and comparing the sense voltage with a fixed reference. When the sense voltage falls below a predetermined value, current through the transformer primary is inhibited for a predetermined time. Current flow is automatically reinstated and the circuit will cyclically cause the power supply to shut down until the fault has cleared. The reference voltage is derived from the tertiary winding voltage resulting in increased sensitivity of the circuit to short duration overload conditions.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction...".
4,351,048	Electrostatic precipitator having dual polarity ionizing cell. An electrostatic precipitator air cleaner having a novel ionizer cell made up of a plurality of positively charged wire-like ionizer electrodes, a plate-like negatively charged passive electrode positioned between and parallel to each adjacent pair of ionizer electrodes, and a box-like enclosure surrounding the ionizer cell such that the side walls of the enclosure adjacent the outermost ones	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction...".

Patent No	Brief Description of Patent	Distinguishing Feature(s) of Claims
	of the ionizer electrodes form grounded electrically conducting surfaces, a relatively high electrostatic field being produced in the region between the ionizer electrodes and the passive electrodes and between the ionizer electrode and the grounded surfaces. In a preferred embodiment, the ionizer electrodes and passive electrodes are impressed with relatively high voltages of equal but opposite polarity such that the spacing between an ionizer electrode and an adjacent passive electrode is twice the spacing between an ionizer electrode and the adjacent grounded surface. United Air Specialties Inc.	
4,379,129	Active carbon with silver deposit is used to decompose ozone	Does not use corona discharge
4,388,274	Ozone collection and filtration system. Charcoal impregnated with sodium iodine is described as a previous art. Also - silver as a catalytic material	Does not use corona discharge
4,390,831	Electrostatic precipitator control system that distinguishes an arc at the end of half-cycle	Does not describe or address electrodes
4,567,541	Previously made of record by Examiner. See Office Action dated 12/21/2000	
4,587,541	Previously made of record by Examiner. See Office Action dated 12/21/2000	
4,600,411	Pulsed power supply for an ESP	Does not describe or address electrodes
4,643,745 (see also 4,689,056 - same authors)	Corona discharge between two electrodes produces air flow then third electrode accelerates this flow without producing more ozone	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,673,416	An air cleaning apparatus having an electrical dust collecting section has discharge electrodes, electrical field forming electrodes arranged parallel to the flow of charged particles, and dust collecting electrodes each of which is arranged between corresponding two adjacent electrical field forming electrodes to be parallel thereto. One high voltage power source is arranged to generate a potential difference between the discharge electrodes and the dust collecting electrodes. Another high voltage power source is arranged to generate a potential difference between the electrical field forming electrodes and the dust collecting electrodes. Negative electrodes consisting of either the electrical field forming electrodes or the dust collecting electrodes are covered by insulator members	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,689,056	1. An air cleaner of the ionic wind type comprising: discharge electrodes of the needle or wire type arranged in a duct for generating corona discharge; a counter electrode arranged downstream of said discharge electrodes; a dust collecting electrode portion having first plate electrodes and second plate electrodes alternately arranged downstream of said counter electrode; a high voltage being supplied from a power source to said discharge electrodes to generate an ionic wind in the direction from said discharge electrodes to said counter electrode to cause said generated ionic wind to be led to said dust collecting electrode, whereby a separation of dust from the air passing through said duct takes place; and an electric potential pick-up electrode being arranged in a vicinity of said discharge electrodes and being electrically connected to said second plate electrodes of said dust collecting electrode portion, said first plate electrodes of said dust collecting electrode portion being grounded, an electric field being generated between said first plate electrodes and said second plate electrodes of said dust collecting electrode portion by supplying the potential of said electric potential pick-up electrode established by the electric field from said discharge electrodes, and dust in the air passing through said duct being collected on said first plate electrodes of said dust collecting electrode portion. 2. An air cleaner according to claim 1, wherein said potential pick-up electrode is arranged between said discharge electrodes and said counter electrode. 3. An air cleaner according to claim 1, wherein said potential pick-up electrode is arranged upstream of said discharge electrodes. 4. An air cleaner according to claim 1, further comprising an acceleration electrode arranged downstream of said counter electrode.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "



Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
	Both electrodes being located on the frames is shown in this invention (but not claimed)	
4,719,535	Negative corona discharge to remove ozone. A wall with multiple holes with needles. The wall is made of manganese dioxide or copper oxide. Contains a cylindric insulating shell, a cylindric electrode block, a conductive needle.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,789,801	<ol style="list-style-type: none"> <li>1. A first array of electrodes</li> <li>2. A second array of maxisectional electrodes</li> <li>3. a source of exciting voltage ... for producing voltage pulses of a single polarity, the durations of which are less than the pulse intervals therebetween</li> <li>4. the first array is substantially equidistant from the closest electrodes in said second array.</li> <li>5. voltage pulses are modulated (width, frequency, etc.)</li> <li>6. (Claim 14) ... a third array of electrodes coupled to a zero voltage reference level (that is for collecting of the particles)</li> </ol>	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,812,711	An arrangement for transporting air with the aid of so-called ion-wind includes at least one corona electrode (K) and at least one target electrode (M) located downstream of the corona electrode at a distance therefrom. The arrangement also includes a direct-current voltage source, the two terminals of which are connected to the corona electrode and the target electrode respectively. The construction of the corona electrode and the voltage of the voltage source are such that a corona discharge generating air ions occurs at the corona electrode. The occurrence of an ion current flowing in a direction upstream from the corona electrode, and thus counteracting the desired direction of air transport, is prevented by effectively screening the corona electrode in a manner such that the strength of any ion current flowing in the upstream direction and the distance through which such an ion current migrates from the corona electrode is practically zero, or in all events much smaller than the product of the ion-current strength and the distance migrated by the ion current in a direction downstream from the corona electrode. The distance from the corona electrode to that part of the target electrode receiving the predominant part of the ion current is at least 50 mm, and preferably at least 80 mm.	Figure 10 shows a number of the corona electrodes located between exciting electrodes. The disclosure fails to describe a distinguishing feature of present patent application (e.g., at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."). As previously described above, the corona electrodes are located symmetrically between the exciting electrodes. Additionally, the corona current flowing from the corona wires to the exciting electrodes is directed ORTHOGONALLY to the desired air flow and can not be used for the air acceleration in the desired direction. It clearly follows from 21, 48-50 that about 10mA of the corona current goes to the exciting electrode and 40mA out of 50mA of the total corona current goes to the target electrode. Therefore, 20% of the total current are essentially wasted.
4,837,658	Corona wire is coated with thin conductive film containing conductive particles. This is to prevent a deposit on the corona wires. Conductive film is made of aluminum hydroxide (Al(OH) <sub>3</sub> ) with graphite powder. Wire - copper - beryllium alloy.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,853,719	Corona wire is coated with thin conductive film containing conductive particles	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,853,735	Ozone removing device that contains volatile agent (terpenoid) and a control means for controlling the volatilization. General formula is C <sub>n</sub> H <sub>2n</sub> + 14 O <sub>2</sub> , n=9-15, n=0-4, p=0-2 as main component and a glycol family as an additive component.	Does not describe or address electrodes
4,924,937	Heat transfer mechanism with needle-point corona electrode	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,941,353	A needle and two plates through which ion wind passes	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes

Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
		with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
4,980,611	Spark projection circuitry that deals with spark AFTER it occurs	Does not describe or address electrodes
4,996,473	Microburst warning system that predicts windshear after a lightning	Does not describe or address electrodes
3,012,159	An arrangement for transporting air, with the aid of an ion-wind, includes a corona electrode (K) at least one target electrode (M) located at a distance from the corona electrode, and a d.c. voltage source (4) connected between the corona electrode and target electrode. The arrangement includes a housing (1, 5) with an inlet opening (2) in which the corona electrode (K) is disposed centrally, and an air-flow path extending from the inlet opening and containing the target electrode (M). The target electrode is located spaced from and symmetrical with the center line through the inlet opening. The housing is configured so that the air-flow path downstream of the inlet opening (2) and the corona electrode (K) branches outwardly towards the target electrode (M), thereby forcing air entering through the inlet opening (2) out towards the target electrode (M) and preventing at least the major part of this air-flow from continuing straight forwards along the extension of the center line.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction."
5,024,085 Torok, et al	An air treatment system which includes a wire-like corona electrode and an air permeable target electrode arranged concentrically around the corona electrode with the electrodes connected to a d.c. voltage source having a voltage causing a corona discharge at the corona electrode and an ion wind through the target electrode. The target electrode may have a substantially cylindrical configuration, in which case air flows axially into the target electrode through one or both of the open ends thereof and exits from the target electrode radially through its air permeable wall. The target electrode may also be divided into two or more separate parts arranged essentially concentrically around the corona electrode in mutually uniform spaced relationship.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction."
5,055,118	Previously made of record by Examiner. See Office Action dated 12/21/2000	
5,077,500	Previously made of record by Examiner. See Office Action dated 12/21/2000.	
5,155,531	1. Solvent must to decompose ozone in a patent electrostatic means 2. A heater to evaporate the solvent 3. a filter to recovering mist 4. solvent mist amount is controlled in accordance to the ozone concentration 5. Silicon oil volatile fluid is used for ozone decomposing	Does not describe or address electrodes
5,245,692	Hemispheric heater	Does not describe or address corona discharge
5,330,559	An electrostatic air cleaner is disclosed along with a method for removing particulate matter from moving streams of air. A high voltage ionizer is used as a corona source to ionize the particulate matter as it approaches the air filter portion of the electrostatic air cleaner. The air filter uses a pair of reticulated polyether foam filters for collecting the particulate matter. The foam filters are separated by a thin, grid-like layer of semiconductive material (carbon-impregnated polycarbonate) which is raised to a very high DC voltage. The foam filters are also surrounded by thin, grid-like layers of electrically conductive material which are held at ground potential, thus creating a high-voltage electric field through each of the foam filters. The polyether foam filter media is non-deliquescent, thus preventing the high-voltage electric field from being dissipated by such imbedded water vapor, which is the cause of filter inefficiency in the prior art. The electrostatic air cleaner of the present invention has such high initial efficiency that it does not require the addition of any particulate matter to its surfaces to achieve its nominal efficiency when first put into use. The air filter can be constructed in a relatively thin, rectangular shape, or in a cylindrical cartridge for use with industrial dust collecting systems. Both shapes lend themselves for ease of installation and removal within air handling systems. United Air Specialists, Inc.	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
5,469,342	Corona generating device having a heated shield	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."

Patent No	Brief Description of Patent	Distinguishing Feature(s) of Claims
5,474,599	An electrostatic air cleaner is disclosed for use in removing particulate matter from moving streams of air. A high voltage ionizer is used as a corona source to ionize the particulate matter as it approaches the air filter portion of the electrostatic air cleaner. The air filter uses reticulated polyether foam filter media for collecting the particulate matter, and the filter media is non-deliquescent, thus preventing the high-voltage electric field from being dissipated by imbedded water vapor, which is the cause of filter inefficiency in the prior art. In one embodiment, the air filter uses strips of conductive material raised to a very high DC voltage interleaved between strips of conductive material held to ground potential, and these strips are oriented so as to be parallel to the direction of the air flow through the air filter's foam filter media, thereby creating an electric field that is perpendicular to the direction of air flow. In a further alternative construction, a charge accumulator is located adjacent to or within the ionizer to collect ions that migrate from the ionizer's electrodes to the collecting member of the charge accumulator. The charge accumulator is raised to a very high DC voltage and is electrically connected to the high-voltage conductive strips of the air filter, thereby eliminating the need for a high-voltage DC power supply to charge these conductive strips directly.	direction " Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction...".
5,556,448	Electrostatic precipitator that operates in conductive grease atmosphere. Includes a high-voltage electrical power supply that has special current limiting features and time delay functions that allow it to operate during relatively brief time intervals when a high-humidity atmosphere exists along with the electrically-conductive grease particulate.	Does not describe or address electrodes
5,578,112	Similar to 6,056,808	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
5,667,564	A miniature air purifier produces a corona discharge surrounding a needle-like emitter point connected to a novel negative 8,000-volt DC power supply. The power supply operates from a nine volt battery and contains a step-up voltage inverter having a single transformer outputting high voltage spikes with a voltage multiplier operating on the output of the inverter. The production of high voltage spikes of about 200 Hz rather than a sinusoidally varying voltage significantly reduces current consumption. The needle-like emitter point is located about 1/4-inch from an 80% open mesh metallic grid held at ground potential. Corona discharge at the emitter point ionizes the air and creates ozone, and nitric oxide both of which combine with direct electron impact decomposition to detoxify and destroy a wide variety of airborne pollutants including pathogens, chemicals and allergens. The grid attracts negatively ionized air molecules thereby creating a flow of purified air out of the device and also provides a surface for electroprecipitation of ionized particulates. An alternative embodiment uses a miniature brushless DC fan to draw room air through a pathogen and pollutant removing filter. The filtered air is exposed to the corona discharge for additional purification and then accelerated out of the device by the emitter point and grid.	Does not disclose or suggest multiple corona electrodes
5,707,428	Previously made of record by Examiner. See Office Action dated 12/21/2000	
5,769,155	Electrohydrodynamic heat exchange.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction ."
5,814,135	Small air purifier. Nice, energy efficient power supply.	Does not have multiple electrodes.
5,827,407	Corona discharge utilizing oscillating electric field.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow

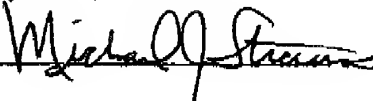
Patent No	Brief Description of Patent	Distinguishing Feature(s) of Claims
5,892,363	Field measuring device for detecting whether lightning is imminent	direction "
5,899,666	Ion drag vacuum pump includes RF ion generator and positive ion dragging device	Does not describe or address electrodes with corona discharge
5,951,957	Method for the destruction of ozone	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
5,973,905	Negative ion generator	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
5,982,102	An attempt to solve back corona problem by separating the corona and target electrodes with insulating layer	Does not disclose or suggest multiple electrodes.
5,993,521 Turuk, et al	A two-stage electrostatic filter includes an ionization section which is arranged in an upstream part of a throughflow passage (28) and includes a wire-like corona electrode (31) which is disposed in an ionization chamber (29) and connected to one pole of an electric high voltage source (16). The filter further includes a target electrode (21,37) which is spaced from the corona electrode (31) and connected to another pole of the high voltage source. A capacitor separator (30) is located in a downstream part of the throughflow passage (28) and includes a first and second group of electrode elements (32,33) which are placed side-by-side in spaced-apart relationship. The electrode elements (32) of the first group are placed alternately with the electrode elements (33) of the second group and are adapted to lie on a potential which is different from the potential on which the electrode elements (33) of the second group lie. The ionization chamber (29) has a target electrode surface (37,21) which is disposed both upstream and downstream of the corona electrode (31). When measured perpendicularly to the upstream-downstream direction of the throughflow passage (28) and to the longitudinal axis of the corona electrode, the distance of the corona electrode (31) from the target electrode surface is at least four times the distance between neighboring electrode elements (32,33). The capacitor separator (30) and the ionization chamber (29) form a disposable unit made of a non-metallic material, preferably a cellulose fibre material.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,042,637	A miniature air purifier produces a corona discharge surrounding a needle-like emitter point connected to a negative DC power supply. The power supply operates from a nine volt battery and contains a step-up voltage inverter having a single transformer outputting high voltage spikes with a voltage multiplier operating on the output of the inverter. The production of high voltage spikes of about 200 Hz rather than a sinusoidally varying voltage significantly reduces current consumption.	Does not disclose or suggest multiple electrodes.
6,056,808	1. An apparatus for purifying gas flowing in a duct or in enclosed space 2. an ionizing unit comprising 3. a water tight housing 4. a high voltage generator including transformer, push-pull drive, voltage multiplier etc. 5. an electrode support rod on which at least one group of ionizing electrodes mounted 6. means for connecting said high voltage generator to an external low voltage power supply 7. a duct comprising a collector electrode 8. a ring posing as an accelerating electrode.	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
6,084,350	Ion generating device that uses flat surface electrodes and AC voltage	Does not disclose or suggest " at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction "
6,145,298	Ion engine for high altitude, very simple	Does not disclose or suggest " at least

Patent No	Brief Description of Patent	Distinguishing Feature(s) of Claims
		one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction...
6,152,146	1 A handheldable body defining at least one vent 2 a high voltage generator that outputs a signal whose duty cycle can be about 10% to about 100% 3 electrically conductive electrode having a pointed tip	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction."
6,163,098	1 A housing a) sized to fit upon a shelf in a closet, and b) a housing sized to directly mate with a 115/220 VAC electrical outlet or 2 A handheldable body 3 High voltage generator with duty cycle of the signal from 10% to about 100%. 4 electrode having a pointed tip or 5 rod-like electrode and ... hollow electrodes	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction."
6,167,196	Space heater (conventional) with angle shape	Does not describe or address electrodes with corona discharge
6,176,977	High voltage generator with duty cycle of the signal from 10% to about 100%. Second electrically conductive hollow electrode	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,182,671	A handheldable body defining at least one vent a high voltage generator that outputs a signal whose duty cycle can be about 10% to about 100% electrically conductive electrode having a pointed tip or ... at least one wire electrode (including a wire electrode) and ... at least two members parallel to said wire	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,200,539	Gas flow accelerator employing flat electrodes on the surface. Uses RF high voltage power supply under 20kHz. Air velocity up to 4m/s	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,203,600	Device for air cleaning. Both electrodes in form of a spiral. Method of manufacturing includes hot melting spacers initially located between the electrodes parts. Alumina bands for corona electrodes are suggested	Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,210,642	Cleaning harmful gases by laser and electron beams	Does not describe or address corona discharge or electrodes
6,245,126	A method of filtering air includes the steps of providing a filter element, providing a pair of electrodes sandwiching the filter element, applying a DC electrostatic field to the electrodes to produce attracting forces between particulates and micro-organisms contained in the air and the filter element, and intermittently applying a sterilizing electrical field concurrently with the electrostatic field. An RF, DC pulse, or AC power supply can be used to generate the sterilizing electrical field	Does not describe or address corona discharge. Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,245,132	Electrically enhanced filter, includes a filter element, a pair of electrodes sandwiching the filter element, a DC, AC, pulse, or RF power supply coupled to the electrode to create an electrostatic field across the filter element and to produce attracting forces between micro-organisms contained in the air and the filter element, and a power supply creating a sterilizing electrical field, which may be either an RF, DC, pulse, or AC power supply coupled to the electrodes and creating discharging or non-discharging voltages on the filter element to destruct the micro-organisms at and in the vicinity of the filter element.	Does not describe or address corona discharge Does not disclose or suggest "... at least one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction..."
6,313,064	A copper alloy comprising 0.1-7.3% of antimony and optionally comprising one or more of zinc, silicon and silver in amounts of 0.001-10%, 0.001-3% and 0.001-1%, respectively, wherein its surface layer	Does not describe or address corona discharge Does not disclose or suggest "... at least

Patent No.	Brief Description of Patent	Distinguishing Feature(s) of Claims
	contains an oxide containing titanium. This copper alloy exhibits sterilizing effect based on copper and antibacterial effect based on optical catalyst function resulting from the oxide which contains titanium dispersed in the surface layer.	one exciting electrode asymmetrically located between said corona electrodes with respect to said desired fluid flow direction such that a desired fluid flow is generated in said desired fluid flow direction...."

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